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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/018,303	10/30/2001	Osamu Sakai	10059-400US (P23013-01)	4864

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EXAMINER	
ALEJANDRO, RAYMOND	
ART UNIT	**PAPER NUMBER**
1745	

DATE MAILED: 03/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

th✓

Office Action Summary	Application No. 10/018,303	Applicant(s) SAKAI ET AL.
	Examiner Raymond Alejandro	Art Unit 1745

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03 January 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4 and 6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4 and 6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10/30/01 & 11/10/03* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 01/03/05 has been entered.

This action is in reply to the amendment accompanying the foregoing RCE. The applicants have overcome the 35 USC 103 rejection. Refer to the aforementioned amendment for details on applicant's rebuttal arguments. However, the present claims are rejected again over new art as presented infra and for the reasons of record:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

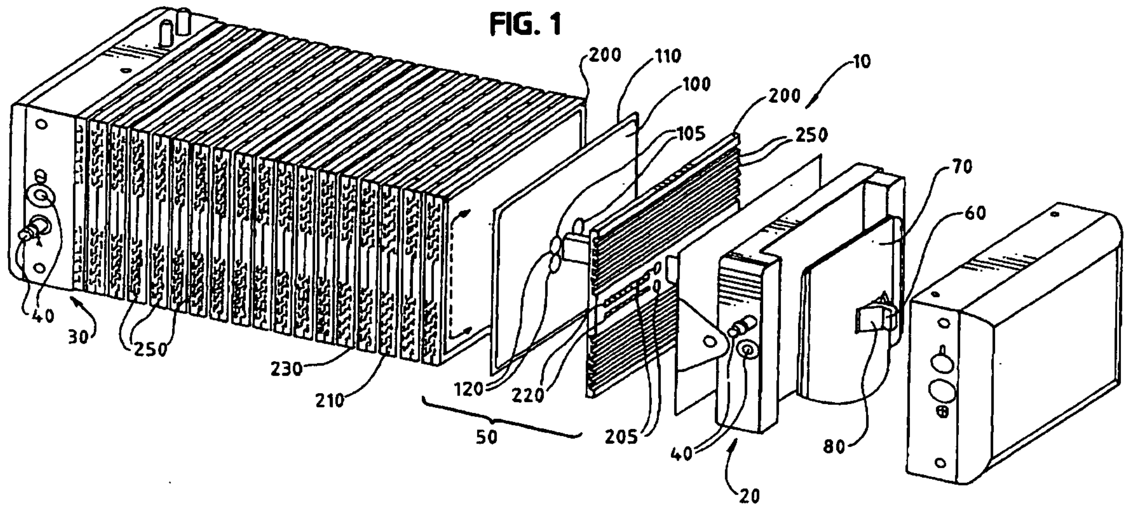
3. Claims 1-3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton et al 6190793 in view of Mattejat et al 5472801, <u>and further in view of McPheeters et al 5882809.</u>

The present claims are directed to a fuel cell wherein the disclosed inventive concept comprises the specific retaining plate forming gap to retain and compress the fuel cell units. Other limitations include the specific retaining plate and separator configuration; and the voltage measurement features

<u>With respect to claims 1-3 and 6:</u>

Barton et al disclose an electrochemical fuel cell stack with an improved compression assembly (TITLE). Figure 1 illustrates a solid polymer electrochemical fuel cell stack 10 including a pair of end plate assemblies 20 and 30, and a plurality of stacked fuel cell assemblies 50, each comprising an MEA 100, and a pair of flow field plates 200 (*the flow field plates are also known in the art as separators*) (COL 7, lines 64-67). As illustrated in Figure 1, each MEA 100 is positioned between the active surfaces of two flow field plates 200. Each flow field plate 200 has flow field channels 210 on the active surface thereof (which contacts the MEA) for distributing fuel or oxidant fluid streams to the active area of the MEA 100 (COL 8, lines 23-33). In the illustrated embodiment, flow field plates 200 have a plurality of open-faced parallel channels 250 formed in the non-active surface thereof (COL 8, lines 34-39).

FIG. 1



Barton et al also disclose that solid polymer electrochemical fuel cells generally employ a membrane electrode assembly (MEA) consisting of a solid polymer electrolyte membrane disposed between two electrodes layers (COL 1, lines 20-26). In typical fuel cells, <u>the MEA is disposed between two electrically conductive separator plates or fluid flow field plates</u> (COL 1, lies 31-39). Fluid flow field plates have at least one flow passage formed therein to direct the fuel and oxidant fluid streams to the respective electrode layers, namely the anode on the fuel side and the cathode on the oxidant side. In a single cell arrangement, fluid flow field plates are provided on each of the anode and cathode sides (COL 1, lies 31-39). It is further disclosed that two or more fuel cells can be connected together to increase the overall power output of the assembly. In series arrangements, one side of a given plate serve as an anode plate for one cell and the other side of the plate can serve as the cathode plate for the adjacent cell, such a series of connected multiple fuel cell arrangement is referred to as a fuel cell stack (COL 1, lines 40-47).

It is disclosed that an elongate tension member extends between and through the end plate assemblies 20 and 30 to retain and secure stack 10 in its assembled state. It is further disclosed that spring plate 70 along with end plates 20 apply a compressive force to fuel cell

assemblies 50 of stack 10 and act as restraining members (COL 8, lines 1-7). *It is apparent from Figure 1 above that the end plate assemblies 20, 30 form a gap therebetween so as to accommodate the fuel cell units in a sandwiched arrangement (that is, the end plate assemblies are spaced apart so as to dispose between the two of them the fuel cell units).*

It is also apparent from Figure 1 above that a laminated and compressed configuration is formed when all components of the solid polymer fuel cell stack with a compression assembly comprising the tension member and a spring plate acting as a unitary resilient restraining member are put together. That is, they all become united into a single unit by compression means and/or a single unit is made by uniting or holding together superposed layers of the MEA, the separator (fluid flow field plate) and the end plates.

Barton et al further disclose that corrective action for electrocatalyst poisoning typically requires the fuel cell to be shut down. For electrocatalyst which is severely poisoned, it may be necessary to dismantle the fuel cell stack and *replace the MEAs* and the components which caused the contamination (COL 3, lines 15-20). Accordingly, there is a need for an improved compression assembly which mitigates some or all of the aforementioned disadvantages which are associated with conventional compression assemblies which employ conductive tension members (COL 3, lines 29-33). *Thus, Barton et al' teaching clearly envision that one of the advantage to use his fuel cell stack with an improved compression assembly is to be able to replace MEAs (membrane electrode assemblies or fuel cell units) which become poisoned. That is, replacing MEAs requires removing the poisoned MEA and re-installing a new MEA.*

Barton et al disclose a fuel cell assembly according to the foregoing aspects. However, Barton et al do not expressly disclose the specific hollow plate structure.

Mattejat et al disclose an electrolyte electrode unit as shown in Figures 4-6 having a functional unit into which a contact plate 77, a plate of carbon paper, an anode 80, a polymer electrolyte membrane (PEM) 82, a cathode 84, a further plate of carbon paper, and a further contact plate 77 are installed in succession (COL 6, lines 5-11). This forms a stack configuration of plate-lie components (COL 2, lines 34-37). It is further disclosed formation of a fuel cell block (COL 1, lies 7-12/ COL 2, lines 13-30) comprising two mutually parallel plates having inner surfaces facing toward each other and outer surfaces facing away from each other; generally flat components resting on both sides of the outer surfaces of the plates in the apparatus and defining a first chamber with one of the outer surfaces at two sides of the component; the inner surfaces of the plates enclosing a third gas tight chamber therebetween; an arbitrary antechamber; and at least one gas tight channel extending between the plates in the plane of the plates (COL 2, lines 15-30).

Figures 4-5 below illustrate the laminated fuel cell stack arrangement:

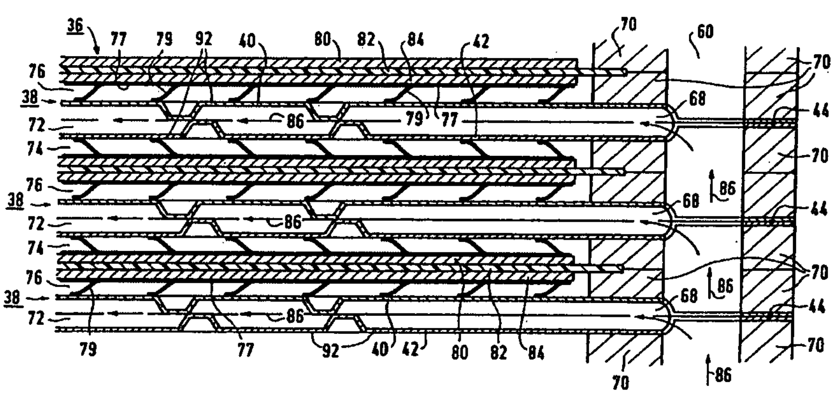


FIG 4

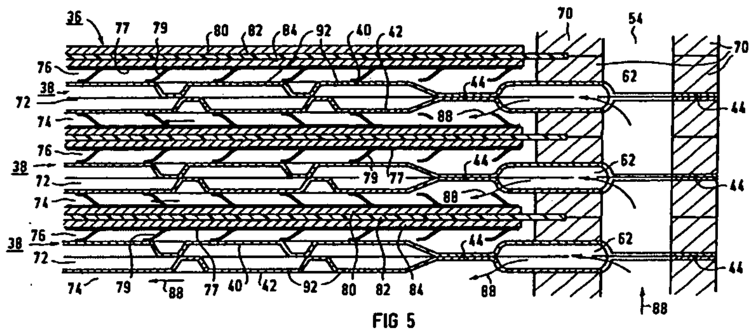


FIG 5

Mattejat et al further disclose the use of a component 38 which includes two plates 40, 42 disposed parallel to one another; the plates 40, 42 are joined to one another by means of a gas tight seam. The plates are constructed in such a way that protuberances of the plates 40, 42 rest against the axial flow line (COL 5, lines 34-47). It is further disclosed that coolant 86 flowing in through the axial channel or the antechamber 60 flows through an inlet end of the channels 68, through the channels 38, out of discharge end of the channels 68, into chambers 72 that are enclosed in gas tight and water tight fashion (COL 6, lines 62-67).

It is also disclosed that in order to space apart the plates 40, 42, it is possible as an alternative to hemispherical protuberances, to provide half-round groove-like protuberances or frustoconical protuberances 92 in the plates 40, 42, having structures which are staggered with respect to one another. The hemispherical or half round groove like or frustoconical protuberance 92 then define the volume and structure of the chamber enclosed by the plates 72 (COL 7, lines 40-48). *Hence, it is asserted that these protuberances somehow impart an undulate cross-section in the hollow space separating one plate from another. It is also contended that the structure of the disclosed fuel cell is substantially equivalent to the structural configuration of the present claims (i.e. two plates forming a hollow section and able to form a gap therebetween).*

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to incorporate the specific hollow plate structure of Mattejat et al'801 in the fuel cell assembly of Barton et al'793 as Mattejat et al'801 disclose the use of hollow plate structure provides high operational reliability of the process control apparatus in the course of supplying and removing liquid or gaseous media. Accordingly, a plurality of axial channels are provided in the peripheral region of the stack configuration, and as a result, it is possible to provide the supply of various media to the various components of the process control apparatus, for instance, the fuel ell block. Furthermore, Mattejat et al also recognize that the hollow plate structured component can be installed in a process control apparatus which can be inserted into a fuel cell block. *Thus, Mattejat et al and Barton et al address the same problem of providing suitable fuel cell components which can be inserted into a fuel cell assembly for optimum performance thereof.*

<u>In addition, the preceding prior art does not expressly disclose the specific configuration for removing and replacing without dismantling the entire stack</u>

McPheeters et al disclose a fuel cell with multi-unit construction and design (TITLE) whereby individual cells may be inspected for defects and interchanged with non-defective single cell units (ABSTRACT). In particular, McPheeters et al teach that single cell units may be individually examined for defects and replaced or interchanged by a non-defective single cell unit without permanently impairing the performance of the stack or without requiring rejection of the entire cell stack (COL 1, lines 20-25/ COL 3, lines 50-59/COL 4, lines 35-40/COL 5, lines 56-62). McPheeters et al disclose that the assembled fuel cell stack is not bonded or fused

together as in a conventional structure, but rather it has means such as clamping for securing the single cell units (COL 7, lines 5-15). *Thus, McPheeters et al at once envisage the use of mechanical elements/components to keep together fuel cells unit in a stack so as to effectively change and replace defective fuel cell units without dismantling the entire fuel cell stack.*

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific configuration for removing and replacing without dismantling the entire stack of McPheeters et al in the fuel cell of both Barton et al and Mattejat et al as McPheeters et al teach that such configuration represents a low cost, easily fabricated, reliable fuel cell stack for applications where high power density is not critical and the interchangeability of defective single cell units is desired. Thus, single cell units may be individually examined for defects and replaced or interchanged by a non-defective single cell unit without permanently impairing the performance of the stack or without requiring rejection of the entire cell stack. *Additionally, McPheeters et al at once envisage the use of mechanical elements/components to keep together fuel cells unit in a stack so as to effectively change and replace defective fuel cell units without dismantling the entire fuel cell stack.*

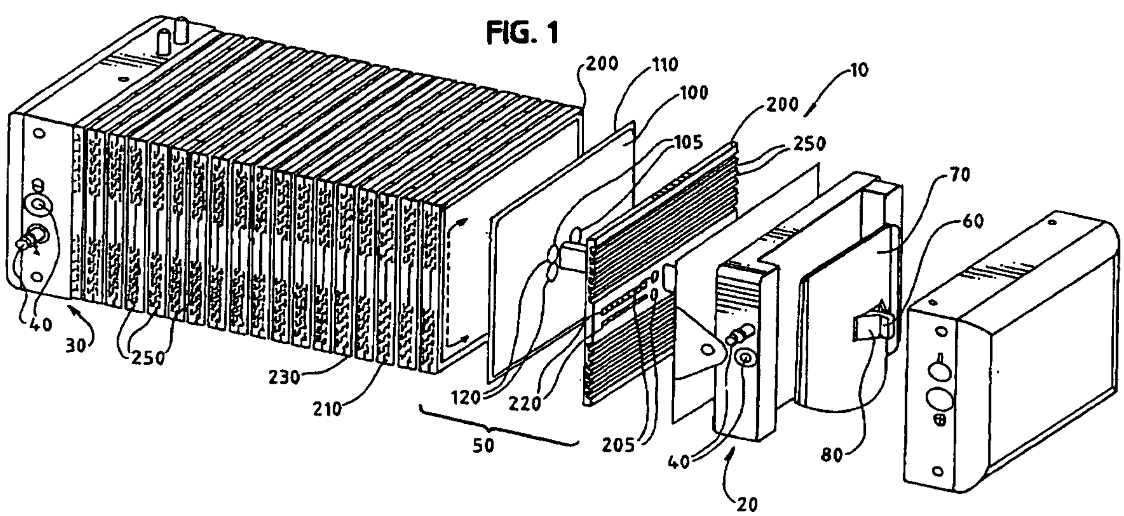
4. Claims 1-3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton et al 6190793 in view of Mattejat et al 5472801, and further in view of Poirier 3554803.

The present claims are directed to a fuel cell wherein the disclosed inventive concept comprises the specific retaining plate forming gap to retain and compress the fuel cell units. Other limitations include the specific retaining plate and separator configuration; and the voltage measurement features

<u>With respect to claims 1-3 and 6:</u>

Barton et al disclose an electrochemical fuel cell stack with an improved compression assembly (TITLE). Figure 1 illustrates a solid polymer electrochemical fuel cell stack 10 including a pair of end plate assemblies 20 and 30, and a plurality of stacked fuel cell assemblies 50, each comprising an MEA 100, and a pair of flow field plates 200 (*the flow field plates are also known in the art as separators*) (COL 7, lines 64-67). As illustrated in Figure 1, each MEA 100 is positioned between the active surfaces of two flow field plates 200. Each flow field plate 200 has flow field channels 210 on the active surface thereof (which contacts the MEA) for distributing fuel or oxidant fluid streams to the active area of the MEA 100 (COL 8, lines 23-33). In the illustrated embodiment, flow field plates 200 have a plurality of open-faced parallel channels 250 formed in the non-active surface thereof (COL 8, lines 34-39).

FIG. 1



Barton et al also disclose that solid polymer electrochemical fuel cells generally employ a membrane electrode assembly (MEA) consisting of a solid polymer electrolyte membrane disposed between two electrodes layers (COL 1, lines 20-26). In typical fuel cells, <u>the MEA is disposed between two electrically conductive separator plates or fluid flow field plates</u> (COL 1,

lies 31-39). Fluid flow field plates have at least one flow passage formed therein to direct the fuel and oxidant fluid streams to the respective electrode layers, namely the anode on the fuel side and the cathode on the oxidant side. In a single cell arrangement, fluid flow field plates are provided on each of the anode and cathode sides (COL 1, lies 31-39). It is further disclosed that two or more fuel cells can be connected together to increase the overall power output of the assembly. In series arrangements, one side of a given plate serve as an anode plate for one cell and the other side of the plate can serve as the cathode plate for the adjacent cell, such a series of connected multiple fuel cell arrangement is referred to as a fuel cell stack (COL 1, lines 40-47).

It is disclosed that an elongate tension member extends between and through the end plate assemblies 20 and 30 to retain and secure stack 10 in its assembled state. It is further disclosed that spring plate 70 along with end plates 20 apply a compressive force to fuel cell assemblies 50 of stack 10 and act as restraining members (COL 8, lines 1-7). *It is apparent from Figure 1 above that the end plate assemblies 20, 30 form a gap therebetween so as to accommodate the fuel cell units in a sandwiched arrangement (that is, the end plate assemblies are spaced apart so as to dispose between the two of them the fuel cell units).*

It is also apparent from Figure 1 above that a laminated and compressed configuration is formed when all components of the solid polymer fuel cell stack with a compression assembly comprising the tension member and a spring plate acting as a unitary resilient restraining member are put together. That is, they all become united into a single unit by compression means and/or a single unit is made by uniting or holding together superposed layers of the MEA, the separator (fluid flow field plate) and the end plates.

Barton et al further disclose that corrective action for electrocatalyst poisoning typically requires the fuel cell to be shut down. For electrocatalyst which is severely poisoned, it may be necessary to dismantle the fuel cell stack and *replace the MEAs* and the components which caused the contamination (COL 3, lines 15-20). Accordingly, there is a need for an improved compression assembly which mitigates some or all of the aforementioned disadvantages which are associated with conventional compression assemblies which employ conductive tension members (COL 3, lines 29-33). *Thus, Barton et al' teaching clearly envision that one of the advantage to use his fuel cell stack with an improved compression assembly is to be able to replace MEAs (membrane electrode assemblies or fuel cell units) which become poisoned. That is, replacing MEAs requires removing the poisoned MEA and re-installing a new MEA.*

Barton et al disclose a fuel cell assembly according to the foregoing aspects. However, Barton et al do not expressly disclose the specific hollow plate structure.

Mattejat et al disclose an electrolyte electrode unit as shown in Figures 4-6 having a functional unit into which a contact plate 77, a plate of carbon paper, an anode 80, a polymer electrolyte membrane (PEM) 82, a cathode 84, a further plate of carbon paper, and a further contact plate 77 are installed in succession (COL 6, lines 5-11). This forms a stack configuration of plate-lie components (COL 2, lines 34-37). It is further disclosed formation of a fuel cell block (COL 1, lies 7-12/ COL 2, lines 13-30) comprising two mutually parallel plates having inner surfaces facing toward each other and outer surfaces facing away from each other; generally flat components resting on both sides of the outer surfaces of the plates in the apparatus and defining

a first chamber with one of the outer surfaces at two sides of the component; the inner surfaces of the plates enclosing a third gas tight chamber therebetween; an arbitrary antechamber; and at least one gas tight channel extending between the plates in the plane of the plates (COL 2, lines 15-30).

Figures 4-5 below illustrate the laminated fuel cell stack arrangement:

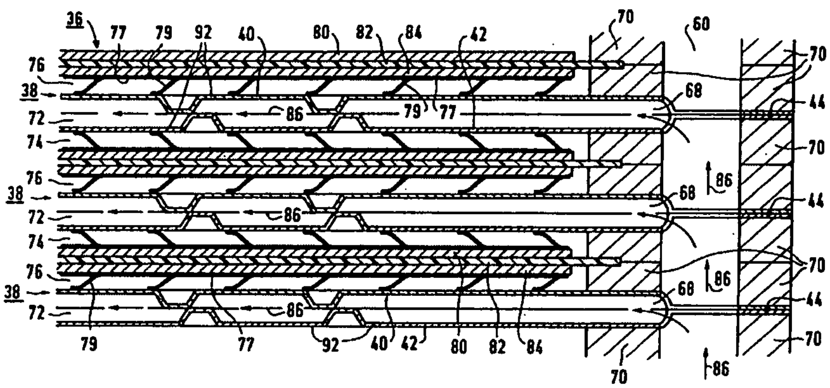


FIG 4

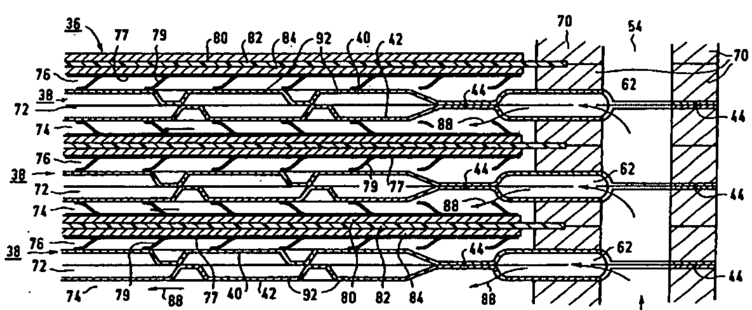


FIG 5

Mattejat et al further disclose the use of a component 38 which includes two plates 40, 42 disposed parallel to one another; the plates 40, 42 are joined to one another by means of a gas tight seam. The plates are constructed in such a way that protuberances of the plates 40, 42 rest against the axial flow line (COL 5, lines 34-47). It is further disclosed that coolant 86 flowing in through the axial channel or the antechamber 60 flows through an inlet end of the channels 68,

through the channels 38, out of discharge end of the channels 68, into chambers 72 that are enclosed in gas tight and water tight fashion (COL 6, lines 62-67).

It is also disclosed that in order to space apart the plates 40, 42, it is possible as an alternative to hemispherical protuberances, to provide half-round groove-like protuberances or frustoconical protuberances 92 in the plates 40, 42, having structures which are staggered with respect to one another. The hemispherical or half round groove like or frustoconical protuberance 92 then define the volume and structure of the chamber enclosed by the plates 72 (COL 7, lines 40-48). *Hence, it is asserted that these protuberances somehow impart an undulate cross-section in the hollow space separating one plate from another. It is also contended that the structure of the disclosed fuel cell is substantially equivalent to the structural configuration of the present claims (i.e. two plates forming a hollow section and able to form a gap therebetween).*

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to incorporate the specific hollow plate structure of Mattejat et al'801 in the fuel cell assembly of Barton et al'793 as Mattejat et al'801 disclose the use of hollow plate structure provides high operational reliability of the process control apparatus in the course of supplying and removing liquid or gaseous media. Accordingly, a plurality of axial channels are provided in the peripheral region of the stack configuration, and as a result, it is possible to provide the supply of various media to the various components of the process control apparatus, for instance, the fuel ell block. Furthermore, Mattejat et al also recognize that the hollow plate structured component can be installed in a process control apparatus which can be inserted into a fuel cell block. *Thus, Mattejat et al and Barton et al address the same problem of providing*

suitable fuel cell components which can be inserted into a fuel cell assembly for optimum performance thereof.

In addition, the preceding prior art does not expressly disclose the specific configuration for removing and replacing without dismantling the entire stack

Poirier divulges a fuel cell designed for efficient stacking wherein a fuel cell has a plurality of unitized fuel cells, each being comprised of conventional fuel cell elements and are mounted in the battery such that each cell operates independently of all other cells in the fuel cell battery, thereby permitting each cell to be removed for repair or replacement without disassembly of the entire fuel cell battery (COL 1, lines 1-20).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific configuration for removing and replacing without dismantling the entire stack of Poirier in the fuel cell of both Barton et al and Mattejat et al as Poirier teach that such fuel cell battery configuration represents a fuel cell designed for efficient stacking wherein each unitized fuel cell operates independently of all other cells in the fuel cell battery, thereby permitting each cell to be removed for repair or replacement without disassembly of the entire fuel cell battery. *Thus, Poirier's teachings clearly envisage designing a fuel cell to effectively and easily remove and replace defective unitized fuel cells without dismantling the entire fuel cell stack.*

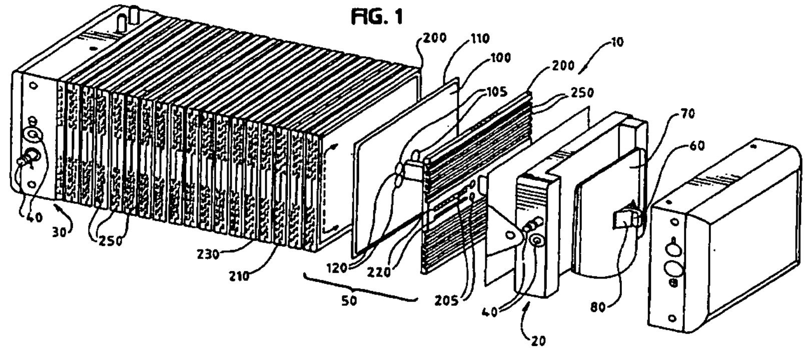
5. Claims 1-3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton et al 6190793 in view of Mattejat et al 5472801, and further in view of Chi 4416955.

The present claims are directed to a fuel cell wherein the disclosed inventive concept comprises the specific retaining plate forming gap to retain and compress the fuel cell units. Other limitations include the specific retaining plate and separator configuration; and the voltage measurement features

With respect to claims 1-3 and 6:

Barton et al disclose an electrochemical fuel cell stack with an improved compression assembly (TITLE). Figure 1 illustrates a solid polymer electrochemical fuel cell stack 10 including a pair of end plate assemblies 20 and 30, and a plurality of stacked fuel cell assemblies 50, each comprising an MEA 100, and a pair of flow field plates 200 (*the flow field plates are also known in the art as separators*) (COL 7, lines 64-67). As illustrated in Figure 1, each MEA 100 is positioned between the active surfaces of two flow field plates 200. Each flow field plate 200 has flow field channels 210 on the active surface thereof (which contacts the MEA) for distributing fuel or oxidant fluid streams to the active area of the MEA 100 (COL 8, lines 23-33). In the illustrated embodiment, flow field plates 200 have a plurality of open-faced parallel channels 250 formed in the non-active surface thereof (COL 8, lines 34-39).

FIG. 1



Barton et al also disclose that solid polymer electrochemical fuel cells generally employ a membrane electrode assembly (MEA) consisting of a solid polymer electrolyte membrane disposed between two electrodes layers (COL 1, lines 20-26). In typical fuel cells, <u>the MEA is disposed between two electrically conductive separator plates or fluid flow field plates</u> (COL 1, lies 31-39). Fluid flow field plates have at least one flow passage formed therein to direct the fuel and oxidant fluid streams to the respective electrode layers, namely the anode on the fuel side and the cathode on the oxidant side. In a single cell arrangement, fluid flow field plates are provided on each of the anode and cathode sides (COL 1, lies 31-39). It is further disclosed that two or more fuel cells can be connected together to increase the overall power output of the assembly. In series arrangements, one side of a given plate serve as an anode plate for one cell and the other side of the plate can serve as the cathode plate for the adjacent cell, such a series of connected multiple fuel cell arrangement is referred to as a fuel cell stack (COL 1, lines 40-47).

It is disclosed that an elongate tension member extends between and through the end plate assemblies 20 and 30 to retain and secure stack 10 in its assembled state. It is further disclosed that spring plate 70 along with end plates 20 apply a compressive force to fuel cell assemblies 50 of stack 10 and act as restraining members (COL 8, lines 1-7). *It is apparent from Figure 1 above that the end plate assemblies 20, 30 form a gap therebetween so as to accommodate the fuel cell units in a sandwiched arrangement (that is, the end plate assemblies are spaced apart so as to dispose between the two of them the fuel cell units).*

It is also apparent from Figure 1 above that a laminated and compressed configuration is formed when all components of the solid polymer fuel cell stack with a compression assembly comprising the tension member and a spring plate acting as a unitary resilient restraining

member are put together. That is, they all become united into a single unit by compression means and/or a single unit is made by uniting or holding together superposed layers of the MEA, the separator (fluid flow field plate) and the end plates.

Barton et al further disclose that corrective action for electrocatalyst poisoning typically requires the fuel cell to be shut down. For electrocatalyst which is severely poisoned, it may be necessary to dismantle the fuel cell stack and *replace the MEAs* and the components which caused the contamination (COL 3, lines 15-20). Accordingly, there is a need for an improved compression assembly which mitigates some or all of the aforementioned disadvantages which are associated with conventional compression assemblies which employ conductive tension members (COL 3, lines 29-33). *Thus, Barton et al' teaching clearly envision that one of the advantage to use his fuel cell stack with an improved compression assembly is to be able to replace MEAs (membrane electrode assemblies or fuel cell units) which become poisoned. That is, replacing MEAs requires removing the poisoned MEA and re-installing a new MEA.*

Barton et al disclose a fuel cell assembly according to the foregoing aspects. However, Barton et al do not expressly disclose the specific hollow plate structure.

Mattejat et al disclose an electrolyte electrode unit as shown in Figures 4-6 having a functional unit into which a contact plate 77, a plate of carbon paper, an anode 80, a polymer electrolyte membrane (PEM) 82, a cathode 84, a further plate of carbon paper, and a further contact plate 77 are installed in succession (COL 6, lines 5-11). This forms a stack configuration of plate-lie components (COL 2, lines 34-37). It is further disclosed formation of a fuel cell block

(COL 1, lies 7-12/ COL 2, lines 13-30) comprising two mutually parallel plates having inner surfaces facing toward each other and outer surfaces facing away from each other; generally flat components resting on both sides of the outer surfaces of the plates in the apparatus and defining a first chamber with one of the outer surfaces at two sides of the component; the inner surfaces of the plates enclosing a third gas tight chamber therebetween; an arbitrary antechamber; and at least one gas tight channel extending between the plates in the plane of the plates (COL 2, lines 15-30).

Figures 4-5 below illustrate the laminated fuel cell stack arrangement:

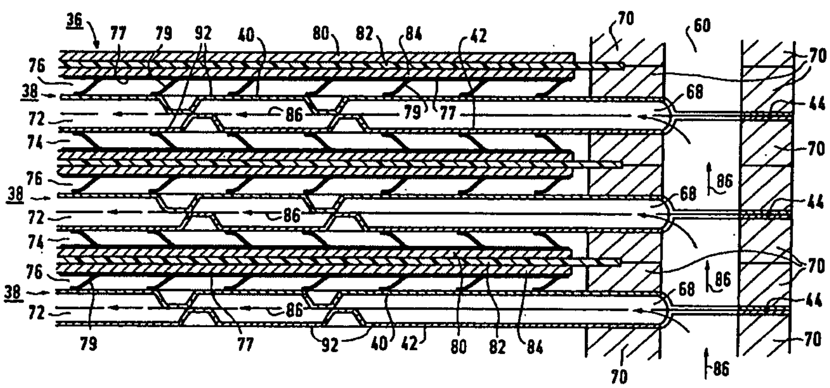


FIG 4

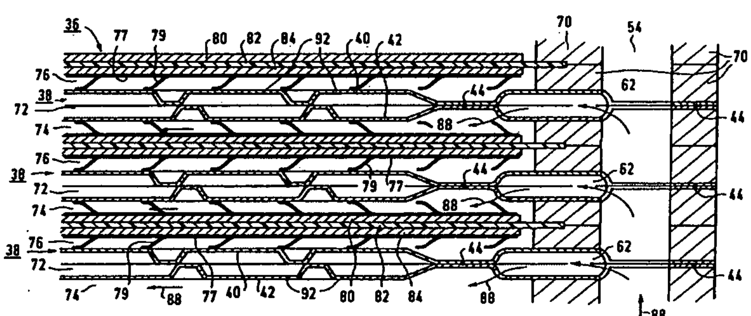


FIG 5

Mattejat et al further disclose the use of a component 38 which includes two plates 40, 42 disposed parallel to one another; the plates 40, 42 are joined to one another by means of a gas tight seam. The plates are constructed in such a way that protuberances of the plates 40, 42 rest

against the axial flow line (COL 5, lines 34-47). It is further disclosed that coolant 86 flowing in through the axial channel or the antechamber 60 flows through an inlet end of the channels 68, through the channels 38, out of discharge end of the channels 68, into chambers 72 that are enclosed in gas tight and water tight fashion (COL 6, lines 62-67).

It is also disclosed that in order to space apart the plates 40, 42, it is possible as an alternative to <u>hemispherical protuberances</u>, to provide <u>half-round groove-like protuberances</u> or <u>frustoconical protuberances</u> 92 in the plates 40, 42, having structures which are staggered with respect to one another. The hemispherical or half round groove like or frustoconical protuberance 92 then <u>define the volume and structure</u> of the chamber enclosed by the plates 72 (COL 7, lines 40-48). *Hence, it is asserted that these protuberances somehow impart an undulate cross-section in the hollow space separating one plate from another. It is also contended that the structure of the disclosed fuel cell is substantially equivalent to the structural configuration of the present claims (i.e. two plates forming a hollow section and able to form a gap therebetween).*

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to incorporate the specific hollow plate structure of Mattejat et al'801 in the fuel cell assembly of Barton et al'793 as Mattejat et al'801 disclose the use of hollow plate structure provides high operational reliability of the process control apparatus in the course of supplying and removing liquid or gaseous media. Accordingly, a plurality of axial channels are provided in the peripheral region of the stack configuration, and as a result, it is possible to provide the supply of various media to the various components of the process control apparatus, for instance, the fuel ell block. Furthermore, Mattejat et al also recognize that the hollow plate

structured component can be installed in a process control apparatus which can be inserted into a fuel cell block. *Thus, Mattejat et al and Barton et al address the same problem of providing suitable fuel cell components which can be inserted into a fuel cell assembly for optimum performance thereof.*

In addition, the preceding prior art does not expressly disclose the specific configuration for removing and replacing without dismantling the entire stack.

Chi discloses a fuel cell sub-assembly (TITLE), specifically, it is disclosed a fuel cell stack comprised of a plurality of cell packs each containing a plurality of fuel cells which are internally connected to form a unit and, therefore, are removable from the stack together and independently of the fuel cells of the other packs (COL 1, lines 21-27). Such fuel cell packs make the detection of defective fuel cells and removal of same from the stack a simple procedure, since an entire pack may be removed from the stack and replaced without disturbing the other packs of the stack (COL 1, lines 21-34).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific configuration for removing and replacing without dismantling the entire stack of Chi in the fuel cell of both Barton et al and Mattejat et al as Chi teaches that such fuel cell configuration make the detection of defective fuel cells and removal of same from the stack a simple procedure, since an entire pack may be removed from the stack and replaced without disturbing the other packs of the stack. Thus, Chi's teachings envision a simplified way of removing and replacing defective single fuel cell units.

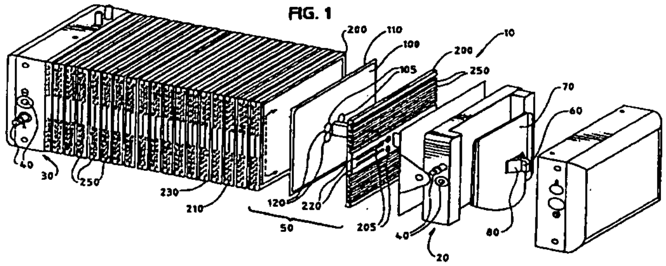
6. Claims 1-3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Barton et al 6190793 in view of Mattejat et al 5472801, and further in view of the Japanese publication JP 64-77880 (hereinafter referred to as the JP'880 publication).

The present claims are directed to a fuel cell wherein the disclosed inventive concept comprises the specific retaining plate forming gap to retain and compress the fuel cell units. Other limitations include the specific retaining plate and separator configuration; and the voltage measurement features

With respect to claims 1-3 and 6:

Barton et al disclose an electrochemical fuel cell stack with an improved compression assembly (TITLE). Figure 1 illustrates a solid polymer electrochemical fuel cell stack 10 including a pair of end plate assemblies 20 and 30, and a plurality of stacked fuel cell assemblies 50, each comprising an MEA 100, and a pair of flow field plates 200 (*the flow field plates are also known in the art as separators*) (COL 7, lines 64-67). As illustrated in Figure 1, each MEA 100 is positioned between the active surfaces of two flow field plates 200. Each flow field plate 200 has flow field channels 210 on the active surface thereof (which contacts the MEA) for distributing fuel or oxidant fluid streams to the active area of the MEA 100 (COL 8, lines 23-33). In the illustrated embodiment, flow field plates 200 have a plurality of open-faced parallel channels 250 formed in the non-active surface thereof (COL 8, lines 34-39).

FIG. 1



Barton et al also disclose that solid polymer electrochemical fuel cells generally employ a membrane electrode assembly (MEA) consisting of a solid polymer electrolyte membrane disposed between two electrodes layers (COL 1, lines 20-26). In typical fuel cells, <u>the MEA is disposed between two electrically conductive separator plates or fluid flow field plates</u> (COL 1, lies 31-39). Fluid flow field plates have at least one flow passage formed therein to direct the fuel and oxidant fluid streams to the respective electrode layers, namely the anode on the fuel side and the cathode on the oxidant side. In a single cell arrangement, fluid flow field plates are provided on each of the anode and cathode sides (COL 1, lies 31-39). It is further disclosed that two or more fuel cells can be connected together to increase the overall power output of the assembly. In series arrangements, one side of a given plate serve as an anode plate for one cell and the other side of the plate can serve as the cathode plate for the adjacent cell, such a series of connected multiple fuel cell arrangement is referred to as a fuel cell stack (COL 1, lines 40-47).

It is disclosed that an elongate tension member extends between and through the end plate assemblies 20 and 30 to retain and secure stack 10 in its assembled state. It is further disclosed that spring plate 70 along with end plates 20 apply a compressive force to fuel cell assemblies 50 of stack 10 and act as restraining members (COL 8, lines 1-7). *It is apparent from Figure 1 above that the end plate assemblies 20, 30 form a gap therebetween so as to accommodate the fuel cell units in a sandwiched arrangement (that is, the end plate assemblies are spaced apart so as to dispose between the two of them the fuel cell units).*

It is also apparent from Figure 1 above that a laminated and compressed configuration is formed when all components of the solid polymer fuel cell stack with a compression assembly comprising the tension member and a spring plate acting as a unitary resilient restraining

member are put together. That is, they all become united into a single unit by compression means and/or a single unit is made by uniting or holding together superposed layers of the MEA, the separator (fluid flow field plate) and the end plates.

Barton et al further disclose that corrective action for electrocatalyst poisoning typically requires the fuel cell to be shut down. For electrocatalyst which is severely poisoned, it may be necessary to dismantle the fuel cell stack and *replace the MEAs* and the components which caused the contamination (COL 3, lines 15-20). Accordingly, there is a need for an improved compression assembly which mitigates some or all of the aforementioned disadvantages which are associated with conventional compression assemblies which employ conductive tension members (COL 3, lines 29-33). *Thus, Barton et al' teaching clearly envision that one of the advantage to use his fuel cell stack with an improved compression assembly is to be able to replace MEAs (membrane electrode assemblies or fuel cell units) which become poisoned. That is, replacing MEAs requires removing the poisoned MEA and re-installing a new MEA.*

Barton et al disclose a fuel cell assembly according to the foregoing aspects. However, Barton et al do not expressly disclose the specific hollow plate structure.

Mattejat et al disclose an electrolyte electrode unit as shown in Figures 4-6 having a functional unit into which a contact plate 77, a plate of carbon paper, an anode 80, a polymer electrolyte membrane (PEM) 82, a cathode 84, a further plate of carbon paper, and a further contact plate 77 are installed in succession (COL 6, lines 5-11). This forms a stack configuration of plate-lie components (COL 2, lines 34-37). It is further disclosed formation of a fuel cell block

(COL 1, lies 7-12/ COL 2, lines 13-30) comprising two mutually parallel plates having inner surfaces facing toward each other and outer surfaces facing away from each other; generally flat components resting on both sides of the outer surfaces of the plates in the apparatus and defining a first chamber with one of the outer surfaces at two sides of the component; the inner surfaces of the plates enclosing a third gas tight chamber therebetween; an arbitrary antechamber; and at least one gas tight channel extending between the plates in the plane of the plates (COL 2, lines 15-30).

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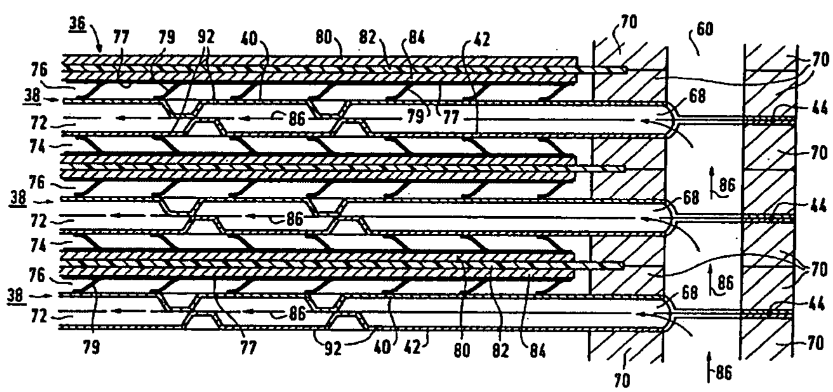

FIG 4

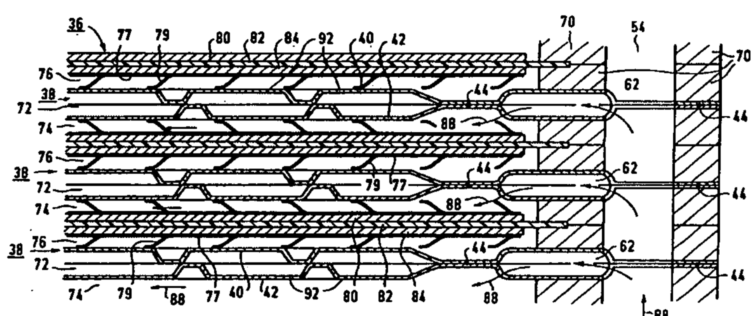

FIG 5

Mattejat et al further disclose the use of a component 38 which includes two plates 40, 42 disposed parallel to one another; the plates 40, 42 are joined to one another by means of a gas tight seam. The plates are constructed in such a way that protuberances of the plates 40, 42 rest

against the axial flow line (COL 5, lines 34-47). It is further disclosed that coolant 86 flowing in through the axial channel or the antechamber 60 flows through an inlet end of the channels 68, through the channels 38, out of discharge end of the channels 68, into chambers 72 that are enclosed in gas tight and water tight fashion (COL 6, lines 62-67).

It is also disclosed that in order to space apart the plates 40, 42, it is possible as an alternative to hemispherical protuberances, to provide half-round groove-like protuberances or frustoconical protuberances 92 in the plates 40, 42, having structures which are staggered with respect to one another. The hemispherical or half round groove like or frustoconical protuberance 92 then define the volume and structure of the chamber enclosed by the plates 72 (COL 7, lines 40-48). *Hence, it is asserted that these protuberances somehow impart an undulate cross-section in the hollow space separating one plate from another. It is also contended that the structure of the disclosed fuel cell is substantially equivalent to the structural configuration of the present claims (i.e. two plates forming a hollow section and able to form a gap therebetween).*

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to incorporate the specific hollow plate structure of Mattejat et al'801 in the fuel cell assembly of Barton et al'793 as Mattejat et al'801 disclose the use of hollow plate structure provides high operational reliability of the process control apparatus in the course of supplying and removing liquid or gaseous media. Accordingly, a plurality of axial channels are provided in the peripheral region of the stack configuration, and as a result, it is possible to provide the supply of various media to the various components of the process control apparatus, for instance, the fuel ell block. Furthermore, Mattejat et al also recognize that the hollow plate

structured component can be installed in a process control apparatus which can be inserted into a fuel cell block. *Thus, Mattejat et al and Barton et al address the same problem of providing suitable fuel cell components which can be inserted into a fuel cell assembly for optimum performance thereof.*

In addition, the preceding prior art does not expressly disclose the specific configuration for removing and replacing without dismantling the entire stack.

The JP'880 publication discloses a fuel cell structure having unit cells (ABSTRACT) wherein if a fuel cell unit is damaged, said unit cell per se is easily replaced (ABSTRACT)

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific configuration for removing and replacing without dismantling the entire stack of the JP'880 publication in the fuel cell of both Barton et al and Mattejat et al as the JP'880 publication teaches that such fuel cell configuration allows for easy replacement of fuel cell units in the event said fuel cell units become damaged. Accordingly, it also allows to efficiently conduct the installation job for stacking a plurality of fuel cells and the replacement job of replacing a damaged cell by forming a suitable structure in which the fuel cell is accommodated in such fuel cell structure. Thus, the JP'880 publication's teachings are also directed to a simplified way of removing and replacing defective single fuel cell units.

7. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over: a) Barton et al 6190793 in view of Mattejat et al 5472801, and further in view of McPheeters et al 5882809; and/or b) Barton et al 6190793 in view of Mattejat et al 5472801, and further in view of Poirier 3554803; and/or c) Barton et al 6190793 in view of Mattejat et al 5472801, and further in view

of Chi 4416955;and/or d) Barton et al 6190793 in view of Mattejat et al 5472801, and further in view of the Japanese publication JP 64-77880 (hereinafter referred to as "the JP'880 publication") as applied to claim 1 above, and further in view of Sawyer 4198597.

Barton et al-Mattejat et al-McPheeters et al; and/or Barton et al-Mattejat et al-Poirier; and/or Barton et al-Mattejat et al-Chi; and/or Barton et al-Mattejat et al-the JP'880 publication are applied, argued and incorporated herein for the reasons above. However, the preceding prior art does not expressly disclose the voltage measurement jig and the voltage display device.

Sawyer et al disclose a negative cell detector for a multi-cell fuel cell stack (TITLE). Sawyer et al disclose a detector for sensing defective cells among a plurality of producing cells forming a source of electrical power (ABSTRACT). The invention relates to a detector for sensing one or more negative cells in a multicelled module and more particularly, to a detector apparatus for continuously monitoring each voltage producing cell of a module in fuel cells to identify faulty or inoperative cells (col 1, lines 6-12).

A series of light emitting diodes are coupled to the positive and negative junction of each voltage producing cell so that they are biased to a nonconducting state so long as the cell has a positive output voltage (ABSTRACT). In the event that a cell becomes defective causing its voltage output to drop, the voltage produced by the remaining cells create a load current by which the defective cell goes negative and forward biases the corresponding light emitting diode. In turn, the light emitting diode changes to its conductive state whereupon it emits light and identifies the defective cell (ABSTRACT).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to incorporate the voltage measurement jig and the voltage display device of

Sawyer et al into the fuel cell system of Barton et al-Mattejat et al-McPheeters et al; and/or Barton et al-Mattejat et al-Poirier; and/or Barton et al-Mattejat et al-Chi; and/or Barton et al-Mattejat et al-the JP'880 publication as Sawyer et al discloses that such devices for detecting and displaying voltage are used for sensing defective cells among a plurality of voltage producing cells which together form a source of electrical power such as the fuel cell. Accordingly, the detector can be used to monitor cells whose voltage levels may be hundreds of volts above ground potential and yet is electrically isolated so that it does not create a safety hazard to the plant facilities or operating personnel. Further, the detector can be used to continuously monitor all the cells in a multi-celled power source to sense negative or non-voltage producing cells but it will only draw power when a particular cell is faulty. Moreover, the detector independently monitors each cell of a multicell power source for negative cells in a manner that any inherent voltage variation of the cells in the stack will not provide an erroneous fault indication. *Accordingly, this is necessary because a totally inoperative cell still connected thereto with the remaining cells of a multi-stacked fuel cell is a particular problem because, in addition, to having no output voltage, its internal impedance normally increases and actually causes a voltage drop across the cell during load conditions. The current forced through the faulty cell by the remaining cells of the stack causes power to be dissipated in the form of heat. This heat is conducted to cells adjacent to the bad cell and can create over-temperature conditions which will reduce the operating life of the adjacent cells.*

Response to Arguments

1. Applicant's arguments with respect to claims 1-4 and 6 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

2. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Fletcher et al 5470671 is directed to circumventing conventional disadvantages including the difficulty of identifying and replacing defective fuel cells without disrupting the operation of the entire fuel cell stack (See COL 2, lines 50-58); Knights et al 6492043 discusses repairing and replacing isolated defective fuel cell units (See COL 2, lines 39-45); and Kelley et al 6214487 discloses the monitoring of individual fuel cell units to identify individual defective fuel cells and replacing an identified failing cell (ABSTRACT/ COL2, lines 55-62/ COL 3, lines 32-35 and 54-56).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (571) 272-1282. The examiner can normally be reached on Monday-Thursday (8:00 am - 6:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Raymond Alejandro
Examiner
Art Unit 1745

RA